National Aeronautics and Space Administration

Commercial Crew Program
John F. Kennedy Space Center

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Crew Transportation Plan

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Record of Revision/Changes

Revision	Description	Date
B-3	Removed Export Control marking for STI	1/28/2015
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Basic	Baselines *Crew Transportation Plan*	12/8/2011

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1.0 Introduction

The National Aeronautics and Space Administration (NASA) Commercial Crew Program (CCP) has been chartered to facilitate the development of a United States (U.S.) commercial crew space transportation capability with the goal of achieving safe, reliable, and cost effective access to and from low Earth orbit (LEO) and the International Space Station (ISS) as soon as possible. Once the capability is matured and is available to the Government and other customers, NASA expects to purchase commercial services to meet its ISS crew rotation and emergency return objectives.

This document defines the processes for Crew Transportation System (CTS) certification and CTS flight readiness, and works in conjunction with supporting documents that address the top-level CTS requirements and standards (reference Figure 1-1). *Crew Transportation System Design Reference Missions* (CCT-DRM-1110) summarizes the potential Design Reference Missions (DRMs) for the CTS, although NASA's current focus is on transporting NASA crew to and from the ISS. *Crew Transportation Technical Management Processes* (CCT-PLN-1120) provides a summary of the technical management processes that support the certification effort and CCP's expectations for evidence of compliance across the life-cycle of the program. *ISS Crew Transportation and Services Requirements Document* (CCT-REQ-1130) and *ISS to Commercial Orbital Transportation Services Interface Requirements Document* (SSP 50808) establish requirements that must be met to achieve CTS certification to transport NASA crew and dock with, or operate in the vicinity of, the ISS. *Crew Transportation Technical Standards and Design Evaluation Criteria* (CCT-STD-1140) and *Crew Transportation Operations Standards* (CCT-STD-1150) are intended to guide the development of the CTS.

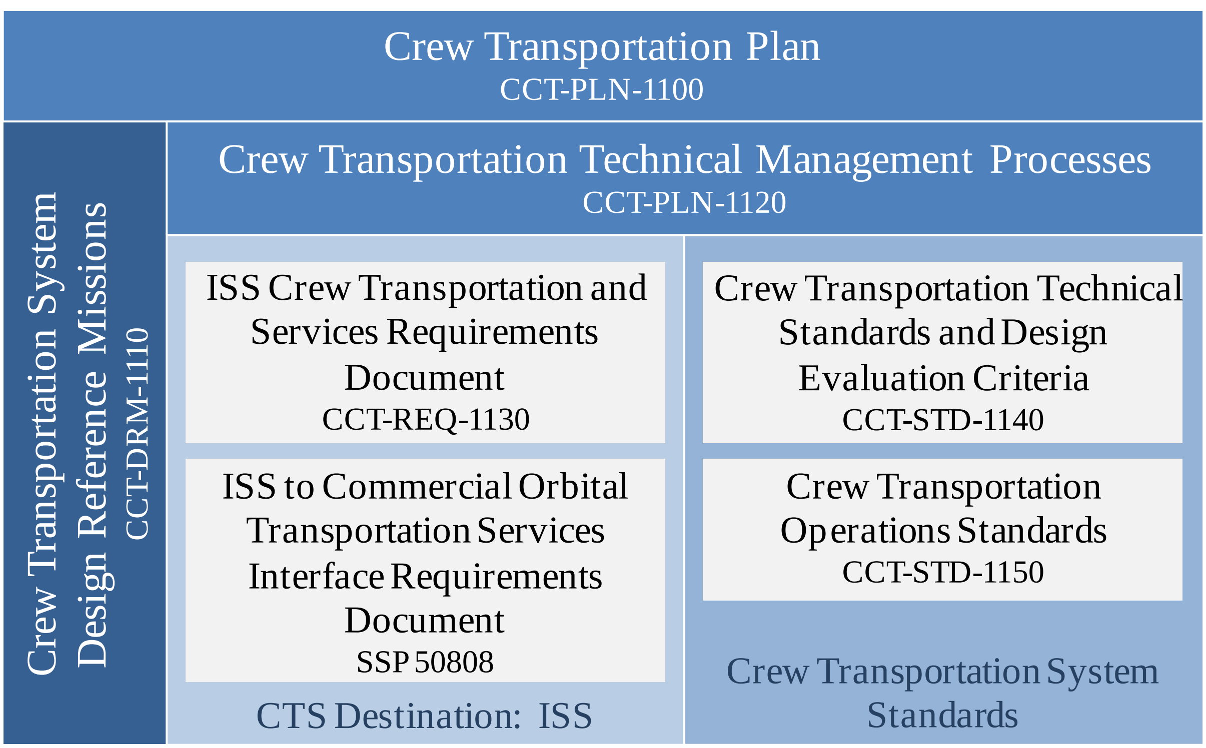


Figure 1-1: Crew Transportation Document Set

1.1 Purpose

The purpose of this document is threefold: 1) to establish the roles, responsibilities, and interfaces of the CCP and the Commercial Providers in the development, certification, and operation of a commercial end-to-end CTS; 2) to define the process for achieving certification to transport NASA crew to and from the ISS; and 3) to provide the linkage between the supporting document set and the certification process.

1.2 Scope

This document and its supporting documents are applicable to the design, development, test, evaluation, certification, production, and operation of the end-to-end CTS. The end-to-end CTS includes all assets and processes required to transport NASA crew to and from the ISS, including:

- An integrated space vehicle.
- Supporting systems for production ground, flight, and recovery operations.
- Capabilities and processes for pre-flight planning and trajectory and abort analysis.
- Crew health and medical care.
- Capabilities and processes for manufacturing, ground processing, mission control, launch control, and post-landing recovery.
- Safety and mission assurance.
- Training processes for operations personnel and crew.

1.3 Delegation of Authority

This document was jointly prepared by the CCP and the ISS Program, and will be managed by the CCP. CCT-PLN-1100 will be maintained in accordance with standards for the CCP documentation. The CCP is responsible for assuring the definition, control, implementation, and verification of the CCP requirements identified in this document.

1.4 Verb Application

Throughout this document and its supporting documents, statements containing *shall* are used for binding requirements that must be verified and have an accompanying method of verification; *will* is used as a statement of fact, declaration of purpose, or expected occurrence; and *should* denotes a statement of best practice.

2.0 Applicable Documents

Document Number	*Title*: Description
CCT-DRM-1110	*Crew Transportation System Design Reference Missions*
CCT-PLN-1120	*Crew Transportation Technical Management Processes*
CCT-REQ-1130	*ISS Crew Transportation and Services Requirements Document*
CCT-STD-1140	*Crew Transportation Technical Standards and Design Evaluation Criteria*
CCT-STD-1150	*Crew Transportation Operations Standards*
SSP 50808	*ISS to Commercial Orbital Transportation Services Interface Requirements Document*

3.0 Crew Transportation Development Approach

3.1 Investment Strategy

The CCP invests in the development of commercial crew space transportation capabilities via milestone-based instruments that support design, development, testing, and demonstration of a portfolio of commercial crew transportation systems. The Commercial Provider is responsible for providing any necessary supplemental investments for the development of a commercial transportation capability.

NASA will use Federal Acquisition Regulation (FAR)-based contracts for the certification of commercially developed capabilities and for the procurement of crew transportation services to and from the ISS to meet NASA requirements. NASA certification will cover all aspects of a crew transportation system, including: development, test, evaluation, and verification; program management and control; flight readiness certification; launch, recovery, and mission operations; sustaining engineering; and maintenance/upgrades. To ensure NASA crew safety, CTS Certification will validate technical and performance requirements, verify compliance with requirements at the subsystem level, process level and safety product level, validate that the CTS operates in the appropriate environments, and accept residual risk to NASA based on the governance model.

The end-to-end CTS are to be managed and operated by the Commercial Providers. The CCP will protect the Commercial Provider's proprietary information that is accessed and used in insight and performance evaluation.

3.2 CCP Insight/Oversight

The Government will use a streamlined Insight/Oversight model in order to maximize efficient Government/Commercial Provider interaction to provide checks and balances, which optimize safety, mission assurance, and the Commercial Provider's success, and to minimize costs. CCP oversight is focused on: baselining CTS requirements and standards; approving Commercial Provider certification plans; approving the completion of milestone entrance and success criteria; managing risk and guiding resolution of potential issues that may impact CTS certification. The CCP will depend heavily on insight, which is modeled as a cooperative partnership to provide NASA the ability to gain a working-level understanding of the Commercial Provider's designs, trades, risks, processes, and implementation, while assisting the Commercial Provider with technical expertise, issue resolution, and value-added independent assessment (reference Appendix C). NASA will review supporting information and participate in the Commercial Provider's milestone events to gain proper insight to evaluate the Commercial Provider's progress in meeting milestones and CTS certification. These milestone events may include:

- Coordination and/or planning forums.
- Readiness reviews.
- Design reviews.
- Engineering boards.
- Simulation reviews and briefings.
- Test reviews and briefings.
- Hardware or operational demonstrations.

This approach minimizes impacts to the Commercial Provider while allowing the CCP to assess the Commercial Provider’s progress towards CTS certification and/or milestones with minimal Government oversight while fostering advancement and flexibility of the Commercial Provider’s design.

The CCP manager directs all Government insight and oversight activities and takes steps to balance the needs of the Commercial Provider with the insight needed to support oversight decisions.

3.2.1 Insight

The Partner Integration Teams (PITs) will be the NASA focal point for the CCP to gain insight into the Commercial Provider’s design and practices. The PIT will primarily utilize the Commercial Provider’s existing and planned activities and technical information to:

1) Gain knowledge and understanding of the Commercial Provider’s requirements, requirements flow-down, and change management, design, and processes;
2) Identify and assess risks that could adversely affect performance milestones;
3) Identify and assess risks that could adversely affect CTS certification; and
4) Assist the Commercial Provider with technical expertise and issue resolution.

The information obtained through insight is used to assist the CCP with programmatic assessments and decision-making in direct support of the Government’s oversight role.

The PIT is an integrated team led by a CCP representative with members from other disciplines, including Engineering, Safety and Mission Assurance (S&MA), Crew Health and Medical (H&M), and Flight Crew and Operations. The ISS Program will participate in CCP activities to identify impacts to ISS controlled operations and hardware/software; will lead ISS interface related safety and risk assessments; and will provide advisory membership to the CCP safety review activities on an as-needed basis.

As the primary/day-to-day points of contact, the PITs establish efficient and effective communication paths, promote collaboration, and act as the liaison between the CCP and the Commercial Provider. PIT leadership will coordinate CCP approval of requests for additional Agency experts to be assigned to support specific short-term insight activities or to aid in the resolution of technical issues and value added independent assessments. PIT members are predominantly based at NASA Centers; however, a small number of CCP personnel may be co-located at or near the Commercial Provider’s facility.

The Commercial Provider is expected to promote timely and open access to all relevant technical information and facilities (to permit attendance to meetings) and documentation relevant to requirements and requirement changes, concept of operations, designs, trade studies, analyses, quality assurance products, verification plans, test data, production processes and data, and supplier data within the scope defined in their agreements and contracts. The PIT members will be responsible for protecting the Commercial Provider’s proprietary data. With this data, the PIT will provide informal feedback to the Commercial Provider and support to the CCP System Offices.

The PIT will establish the appropriate access-level and process for sharing Government-owned information and data with the Commercial Provider in accordance with the terms of the contract and/or based on publically available information, such as NASA-owned/non-proprietary specifications, standards, lessons learned, and data.

The PIT is expected to bring value through strong technical relationships with their Commercial Provider counterparts. PIT members will work side-by-side with the Commercial Provider; however, the PIT members will not sign or approve any products from the Commercial Providers. CCP insight is focused on any impacts to top-level CCP requirements or impacts to certification. The CCP will ensure consistency in the approach and the level of detail provided to each Commercial Provider.

3.2.2 Oversight

Approval authority for all Commercial Provider oversight activities resides with the CCP manager. The CCP manager receives support for oversight activities from the CCP Systems Offices. These program-level organizations develop recommendations for program requirements, establish program oversight processes leading to CTS certification (which require CCP manager approval), and analyze industry feedback on CCP requirements and oversight processes.

The CCP is responsible for defining the requirements for the end-to-end CTS with support from the ISS program. The ISS Program is responsible for defining the ISS to spacecraft interface and ISS rendezvous, proximity operations, and docked operations requirements, and will review and approve verification closure of associated requirements. The ISS Program will also support the CCP for CCP closure of ISS requirements and planning for any joint ISS mission operations activities. The CCP will review and approve verification closure of all other requirements. A Joint Program Requirements Control Board (JPRCB) has been established as the ISS-CCP forum for final disposition of joint technical and programmatic issues and/or the approval of joint program requirements and agreements.

The CCP will utilize a two-board structure to streamline decision-making and decrease response time to the Commercial Provider; these boards are the CCP Technical Review Board (TRB) and the CCP Program Control Board (PCB).

The TRB supports the PCB with the technical management, systems engineering, and integration for program requirements. Specifically, this board is chartered to review the verification of requirements and recommend disposition when a requirement cannot be met by the Commercial Provider and/or requires change. The TRB is also chartered to manage the safety review process, which has traditionally been a separate board in previous programs, evaluate assessments of safety or technical risk issues, and recommend any independent analysis/assessment that may affect certification.

The PCB holds the determination authority for milestone success/acceptance and the change authority for negotiated changes or amendments to CCP approved items (e.g., milestone success criteria, NASA requirements, formal guidance and/or assessment transmission to the Commercial Provider, NASA requirement waivers/exceptions, standards, etc.). Additionally, contract deliverables related to CTS certification which require program approval will be approved at this board.

The PCB is chaired by the program manager or delegate with representation from all CCP offices and supporting organizations, such as Engineering, S&MA, H&M, Flight Crew, Ground and Mission Operations, and the ISS Program. Representatives from other affected NASA programs/organizations, the Federal Aviation Administration (FAA), and the Commercial Provider can attend, as necessary. The TRB is chaired by the SE&R manager or delegate with the same representation as the PCB.

The Commercial Provider can request attendance and can contribute to CCP board discussions, as well as request agenda items to discuss cost, schedule, or technical issues/risks outside the scheduled

Milestone Reviews or request changes or amendments. The CCP will work with the Commercial Provider to resolve any potential impacts to full acceptance at the Milestone Reviews. The Commercial Provider's boards and panels can request to operate jointly with the CCP boards to resolve technical issues efficiently.

3.3 Program/Project Management

The Commercial Provider is fully responsible for all program/project management, systems engineering management, safety and mission assurance, and logistics management functions required for executing each life-cycle phase, which includes the full integration of end-to-end CTS. Inherent safety tenets employed include strong in-line checks and balances, healthy tension between responsible organizations, and value-added independent assessments. The Commercial Provider will develop/modify and implement plans/processes to facilitate proper controls for hardware and software during the design, development, test and verification, production, mission planning, ground assembly/integration, launch, mission, and recovery operations, and if applicable, maintenance, refurbishment, and disposal of spacecrafts and launch vehicles. The Commercial Provider will develop/modify and implement plans and processes to ensure implementation of peer reviews/checks and independent assessments of critical design, analysis and test products, and implementation of a process for raising and resolving dissenting opinions. The Commercial Provider will develop and execute a certification plan that will verify requirements compliance and validate that the components, subsystems, and systems of the CTS accomplish the intended purpose when operated in the intended environment throughout the life-cycle. NASA's summary of these plans/processes is covered in CCT-PLN-1120, CCT-STD-1140, and CCT-STD-1150.

The CCP will continuously review and assess the Commercial Provider's compliance with their plans by engaging in reviews with the Commercial Provider on issues affecting compliance with requirements, non-conforming hardware, deviations from controlled processes, safety issues, and managing risks within the design, production and operations. Periodic reviews such as quarterly status reviews will provide understanding of issues throughout the certification phase and subsequent to the initial certification. A thorough review and understanding of these plans and their implementation conditions are paramount to accepting the residual risks of the CTS. NASA will also verify that a Commercial Provider's production, critical planning, processes, and inspections (utilized to manufacture flight articles or maintain reusable elements) are compatible with the Commercial Provider's hardware and software design and producibility assertions.

The Commercial Provider is responsible for coordinating/obtaining the use of all facilities, infrastructure, and services associated with each mission phase, including the use of NASA-owned facilities, infrastructure, or services. The CCP will not separately fund facility/capability costs. The Commercial Providers will work directly with NASA centers or other agencies for the use or modification of existing NASA or other Government facilities and will enter into agreements, as applicable, to support their end-to-end solutions. The CCP will provide contact information and can assist in facilitating discussions as needed, but will not broker on behalf of a Commercial Provider or a center. The CCP will have insight into these agreements to assess impacts to the program's schedule and technical performance.

3.3.1 Risk Management

The Commercial Provider will define, own, and manage their risk management process (reference CCT-PLN-1120). The risk management process will enable the Commercial Provider to identify, mitigate or

resolve, and communicate risks throughout all phases of the life-cycle. NASA will have insight into the Commercial Provider's risk management process and resultant data. Significant risks will be elevated within the CCP by the PIT, paying particular attention to those risks that pose a threat to CTS certification and meeting milestone criteria. The CCP will also own and maintain a NASA risk management process to manage program, investment, certification, and milestone risks. The CCP and the Commercial Provider will jointly understand and manage the risks associated with crew health and safety and mission success, and will collaborate towards the successful compliance with CTS requirements and certification.

3.3.2 Requirement and Standards Management

The CCP approach to CCP requirements is formulated specifically to eliminate over-specification of requirements and to implement the lessons learned throughout the Agency's history regarding the consequences of ineffective requirements control. There are two principles the CCP considers essential to facilitating commercial industry's ability to develop safe and cost-effective crew transportation capabilities:

1) Establishment of the minimum set of high-level NASA Program requirements necessary to define needed system capabilities, performance, and crew safety attributes; and
2) Disciplined technical leadership to establish and maintain a culture and processes that rigorously limit NASA requirements changes once approved.

NASA has established the potential DRMs that govern the investment in, and development of, commercial crew transportation in CCT-DRM-1110. For the ISS DRM, NASA has established the requirements and standards for certification to transport NASA crew to and from the ISS in CCT-PLN-1120, CCT-REQ-1130, CCT-STD-1140, CCT-STD-1150, and the ISS interface requirements in SSP 50808. NASA is responsible for defining, managing, reviewing, and approving verification closure of these requirements related to CCP missions. The CCP expects the Commercial Providers to flow down these program-level requirements to end-item specifications.

The Commercial Provider will own and maintain configuration control (reference CCT-PLN-1120) over all lower-level requirements, specifications, and drawings that govern the development of their CTS. The CCP will have insight into the Commercial Provider's requirement change/waiver process and will assess any changes impacting the implementation of NASA requirements.

NASA will also perform independent verification and validation activities commensurate with the Commercial Provider's CTS maturity and flight history. These may include disciplines, such as integrated loads and environments, and flight software. Any unique information necessary to support this activity from the Commercial Provider will be specified in the contract.

NASA has established the evaluation criteria for technical standards in CCT-STD-1140 and CCT-STD-1150. The CCP, using internal and external subject matter experts, will evaluate the Commercial Provider's standards that govern their design and engineering practices. The evaluation process will be open and include full Commercial Provider participation, and will result in a partnered set of standards for the Commercial Provider's CTS. The Commercial Provider will maintain configuration control of the set of resultant standards. The CCP will have insight into the Commercial Provider's standards change/waiver process and will assess any changes and provide structured feedback, as standards are an integral part of CTS certification.

Should NASA determine the need to change any requirement in CCT-REQ-1130, SSP 50808, or any partnered standards, the CCP will request an impact assessment from the Commercial Provider to include in the change evaluation package.

Where the evaluation of technical standards and NASA requirements results in non-compliance, the CCP will disposition requests for variance as described in CCT-PLN-1120.

4.0 NASA Crew Transportation System Certification Process

4.1 CTS Certification

The CTS certification process results in the approved use of an end-to-end CTS in the applicable DRM for the transportation of NASA crew. NASA's CTS certification process begins in the design phase and continues through "flight readiness." While certification is discussed in terms of design, production and operations, it should be noted that multiple certifications are not performed or granted for a single mission. As the CTS design matures, the primary focus of the Providers and NASA will shift from design to production, and then to operations, and portions of these elements are executed concurrently (reference Figure 4-1).

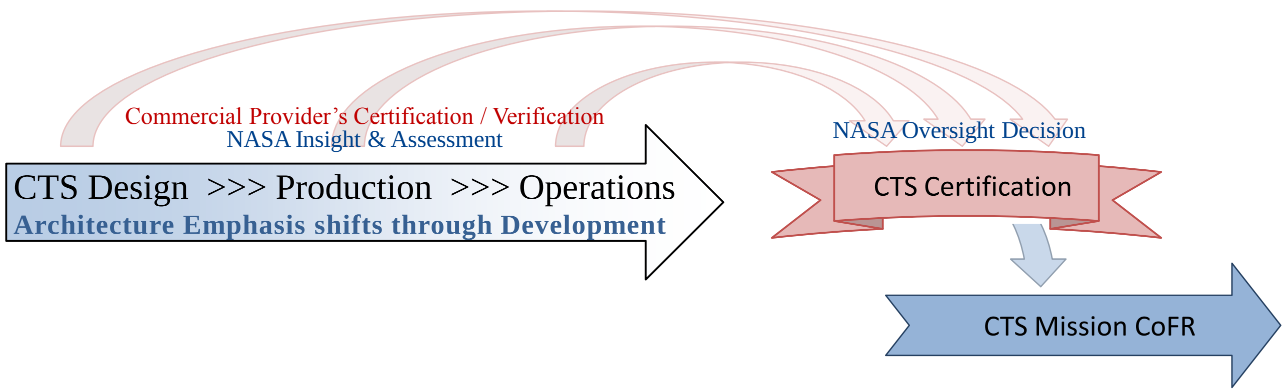


Figure 4-1: CTS Certification Elements

For CTS design architecture development, CCP insight will place emphasis on trades studies and analyses used to support design decisions and all tests, demonstrations, and/or inspections supporting the Commercial Provider's certification plan. For production architecture development, the CCP will place emphasis on insight into the production and assembly processes that implement failure tolerance redundancy and hazard controls and the tests, analyses, demonstrations, and/or inspections supporting the verification of the as-built CTS. For the operations architecture development, the CCP will place emphasis on insight into the pre-planned procedures for reacting to Launch Commit Criteria (LCC) and Flight Rule excursions, responding to mishaps and contingencies, and the processes for real-time operations management and decision-making. For all elements, CCP insight will place emphasis on processes used in identifying, understanding, eliminating, and controlling hazards and risks to safety and mission success. The criteria used in the evaluation of this data are established in CCT-PLN-1120, CCT-REQ-1130, CCT-STD-1140, and CCT-STD-1150.

Results of the Commercial Provider's tests, analyses, demonstrations, and/or inspections will be formally evaluated to obtain CCP concurrence in the Commercial Provider's progress towards CTS certification (reference Figure 4-2).

Upon successful completion of the flight test phase of crewed flights, an Operational Readiness Review (ORR) will be conducted by the Commercial Provider. The ORR occurs once during the program life cycle (or at the introduction of new or significantly modified systems/facilities). The purpose of this review is to evaluate all program and support (flight and ground) hardware, software, personnel, plans,

processes, and procedures to ensure flight and associated ground systems are in compliance with program requirements and constraints during the sustaining phase. This review informs the Agency Certification Review.

The CCP will conduct a Certification Review with the Commercial Provider upon successful completion of all flight tests, any delta DCRs, and the ORR to determine that the CTS meets the full DRM to transport NASA crew to the ISS. Following the CCP determination of readiness, the CCP will facilitate an Agency-level review to grant the Commercial Provider approval to transport NASA crew to the ISS based on evidence of satisfactorily completing the CTS certification. This review will include ISS Program concurrence for the completion of the ISS Integration Process for Visiting Vehicles.

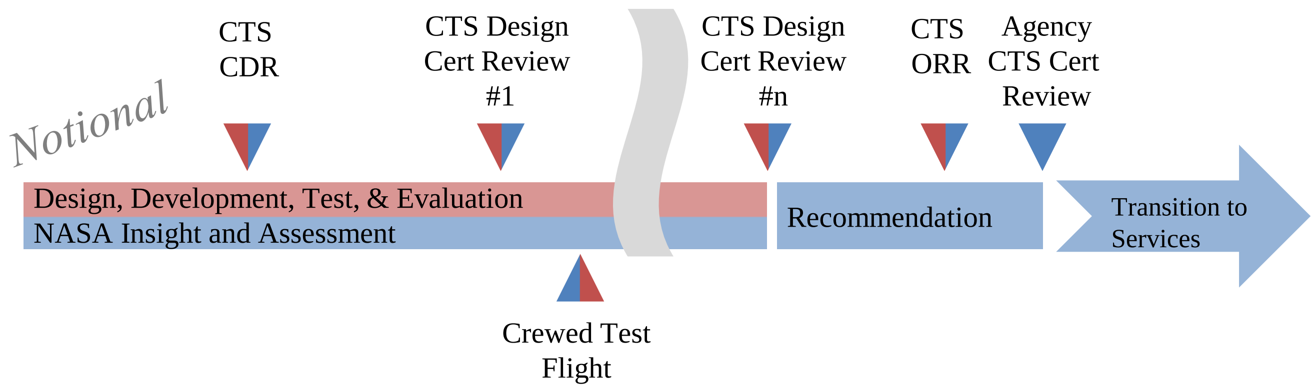


Figure 4-2: CTS Certification Timeline

4.2 Flight and Flight Test Management in Certification

The Commercial Provider will define (with CCP approval), manage, and execute an end-to-end flight readiness process (reference Section 5.0). This flight readiness process will validate that a mission-specific CTS was manufactured, produced, and integrated within the approved NASA CTS certification; verify that all modifications have completed certification; verify that the CTS processing and operating plans will operate the CTS within the operational limits; and verify that all critical personnel and crew have been properly trained. The flight readiness process concludes at a NASA Flight Readiness Review (FRR), or Flight Test Readiness Review (FTRR) in the case of a crewed test flight. The purpose of this review is to request approval to proceed to Launch Countdown for a mission that transports NASA crew and to document the formal acceptance of risk by NASA and the Commercial Partner. Upon successful completion of each FRR and closure of open work, NASA will grant CTS Certification of Flight Readiness (CoFR) for that mission.

The Commercial Provider will also define, control, and execute the process to manage design modifications effective after NASA CTS certification. NASA will continue monitoring the Provider's execution of processes with the focus shifting to evaluation of changes to the design, production, and operational baseline established in the original certification. In addition, continued operation of the system may expose unknown risks through post-flight reconstruction, production failures, obsolescence, or in-flight anomalies. NASA will not assume the responsibility for baseline maintenance of the certification but will be involved through insight in the assessment of changes. The Commercial Provider will collaborate with the CCP on proposed hardware/software changes, the associated validation and verification methods, and the acceptance for implementation. All changes to requirements, design, or processes will be evaluated by the Commercial Provider to determine the

impact to CTS certification. The CCP PCB, with Commercial Provider representation, will determine the need for a recertification. Recertification is to be completed prior to the next effected NASA FRR.

Flight tests conducted as part of the verification, validation, and certification effort will follow a NASA-approved test plan linked to test objectives (reference CCT-PLN-1120). If any test flights include operating within the vicinity of and docking to the ISS, then the CCP will ensure that the ISS Program has insight, participation, and concurrence in the flight test readiness process.

Prior to the first LEO crewed test flight, the flight test readiness process will include a Design Certification Review of applicable elements from completed CTS Certification Milestones (for an interim CTS certification) and a FTRR. The DCR will formally document the configuration baseline (hardware, software, and processes used in design, production, and operations) and the conditions under which the CTS is certified (performance, fabrication and operational environments, constraints).

A contractor-led Joint Test Team (JTT) will conduct crewed flight tests. The JTT will work together providing flight test capabilities to the operations certification effort. This JTT approach will integrate commercial and NASA personnel in order to leverage the depth of design and systems knowledge provided by the commercial operator with the breadth of flight test and spaceflight experience brought by NASA operators.

NASA personnel will provide embedded insight on the test team assisting the contractor with technical expertise, issue resolution, and value-added independent assessment. NASA participation will be an insight role, not oversight. The focus of the JTT will be on operational interfaces with the vehicle in order to validate the system in the operational environment. It will provide an opportunity for qualitative assessments such as handling qualities (including manual control in appropriate phases), situational awareness, operational complexity and workload of tasks, cockpit layout, displays and controls, flight crew suits, mission planning, training, procedures, and flight and ground operations processes. The NASA members on the JTT will provide experience/expertise to the Commercial Provider during the development of flight test plans, procedures, crew and flight controller training requirements documentation needed to operate the vehicle during crewed flight tests.

5.0 Flight Readiness Process

The CTS flight readiness process results in concurrence to proceed to Launch Countdown for a specific CTS flight to transport crew. NASA's flight readiness process includes the assessment of the design and verification of CTS modifications, the production and assembly of CTS elements, and the development of flight-specific operations procedures. NASA's flight readiness determination is based on insight into the implementation and verification of CTS modifications and insight into execution of processes, tests, analyses, demonstrations, and/or inspections; operational controls supporting the verification of the as-built CTS; the execution of integration and launch preparation procedures; and anomaly resolution (reference Figure 5-1).

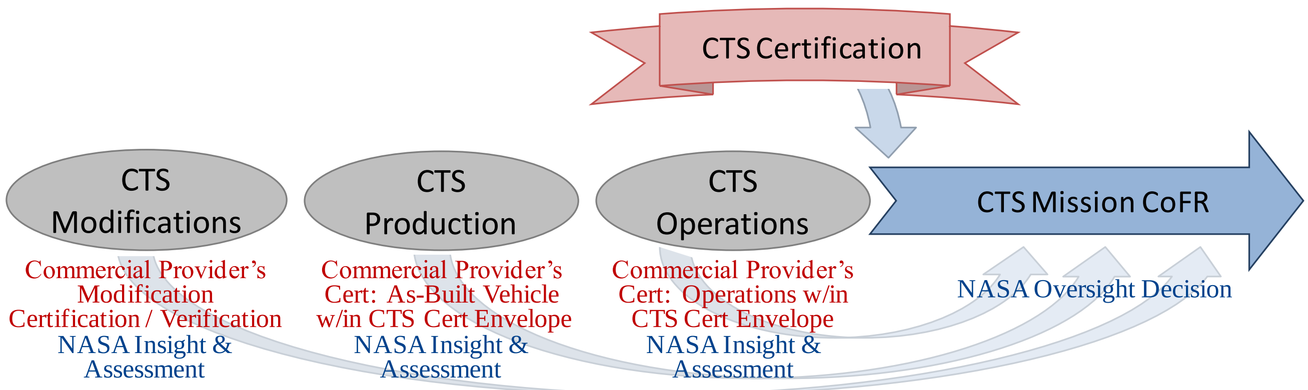


Figure 5-1: Flight Readiness Elements

Results of the Commercial Provider's tests, analyses, demonstrations, and/or inspections will be formally evaluated, as described in CCT-PLN-1120, at Readiness Reviews that will be held at key points in the production, ground operations, and mission planning efforts (reference Figure 5-2). If changes and/or deviations to the certified CTS configuration have been made, the changes from the approved CTS certification and appropriate evaluations and certification data will be presented and reviewed for acceptance as part of the flight readiness process. The purpose of the Readiness Reviews is to evaluate CTS production and operation progress, technical issues and requirement deviations/waivers, and the closure of any actions before proceeding to the next mission preparation phase.

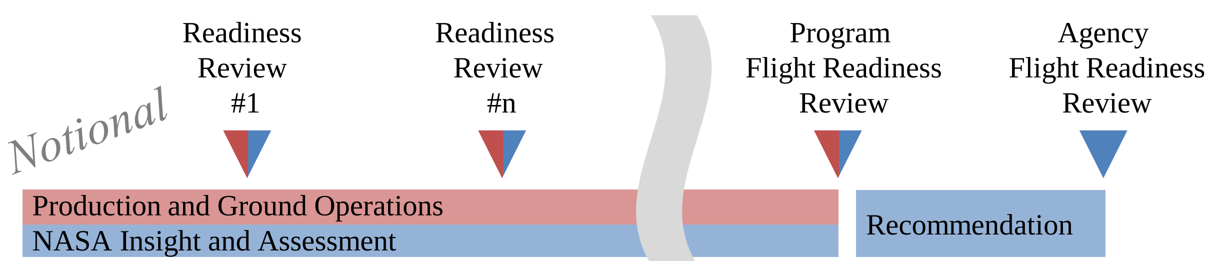


Figure 5-2: Notional CTS Flight Readiness Timeline

The flight readiness process culminates at the CCP FRR and the NASA FRR. The purpose of the CCP FRR is to evaluate readiness of all personnel, elements, and assets to support the launch and execution of the mission. Further, the process will verify that all risks, including past flight anomalies, have been identified, credibly assessed, and characterized, and that mitigation efforts have been implemented or residual risks have been accepted prior to proceeding to the next phase. Upon CCP determination of

readiness at the CCP FRR, the CCP will develop the CTS CoFR Recommendation to be presented at the NASA FRR, chaired by the NASA HEO Mission Directorate Associate Administrator. The purpose of this review is to request approval to proceed to Launch Countdown for a mission that transports NASA crew and to document the formal acceptance of risk by NASA and the Commercial Partner. For ISS missions, this is also based on ISS readiness for CTS spacecraft arrival. Authority-to-Proceed into Launch Countdown initiates the Mission Management process (reference Section 6.0).

6.0 CCP Mission Management Process

The CCP mission management process is the controlling framework for conducting CTS operations, nominal and off nominal, effective from FRR through crew recovery. This process oversees the execution of the operations plans and procedures approved during the flight readiness process, ensures the CTS is operated within the certified operational limits of the LCC and Flight Rules, and enables the timely identification and resolution of potential impacts to crew health and safety and mission success.

The CTS mission management process for CCP transportation missions will be conducted jointly by CCP, Commercial Provider and ISS mission leaders.

The Commercial Provider is authorized to perform the real-time mission operations within the limits of certification and according to the rules, procedures and flight plans authorized by NASA at the FRR. The ISS Program will oversee joint operations, including ISS docked operations, rendezvous/proximity operations, docking, undocking/separation, and communications between vehicles during proximity operations and the docked timeframe. Deviation from the FRR accepted levels of risk to the NASA crew or mission require the concurrence of the NASA Mission Management Team (MMT). The MMT will approve all real-time changes, deviations or waivers to LCC or Flight Rules. Approval to exceed certification limits, or deviate from mission plans sufficiently to constitute a change in risk acceptance requires concurrence from the MMT. The Provider represents their technical system and provides CTS and mission status to the NASA MMT.

NASA may also identify specific Go/No-Go milestones to evaluate CTS performance and crew health, resolve technical issues and in-flight anomalies, and to grant Authority-to-Proceed to the next mission phase. The knowledge gained through insight, independent review, and evaluation will support NASA Go/No-Go decisions for key mission milestones.

Appendix A: Acronyms

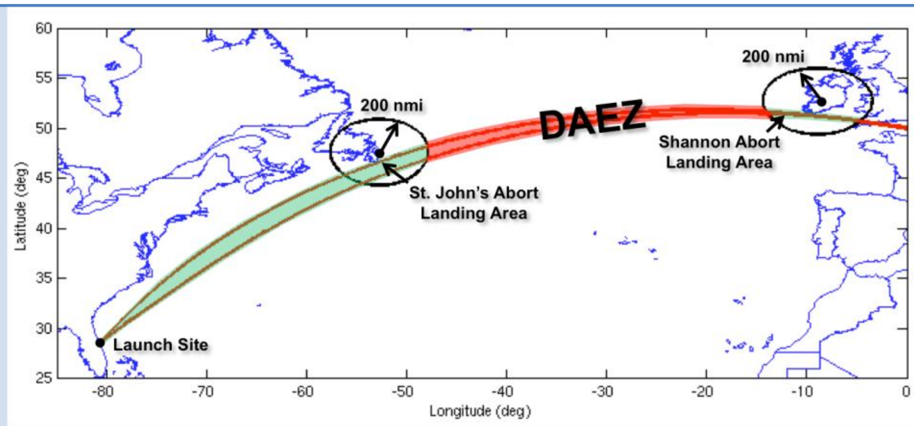
Acronyms	Phrase
CCP	Commercial Crew Program
CoFR	Certification of Flight Readiness
CTS	Crew Transportation System
DRM	Design Reference Mission
FAA	Federal Aviation Administration
FRR	Flight Readiness Review
H&M	Health and Medical
ISS	International Space Station
JTT	Joint Test Team
L&RS	Launch and Recovery Systems
LCC	Launch Commit Criteria
LEO	Low Earth Orbit
MMOD	Micrometeoroids and Orbital Debris
MP&I	Mission Planning and Integration
NASA	National Aeronautics and Space Administration
PCB	Program Control Board
PIT	Partner Integration Team
S&MA	Safety and Mission Assurance
SE&R	Systems Engineering and Requirements
TRB	Technical Review Board
U.S.	United States

Appendix B: 1100 Series Definitions

Term	Definition
Abort	The forced early return of the crew when failures or the existence of uncontrolled catastrophic hazards prevent continuation of the mission profile and a return is required for crew survival.
Ambient Light	Any surrounding light source (existing lighting conditions). This could be a combination of natural lighting (e.g., sunlight, moonlight) and any artificial light source provided. For example, in an office there would be ambient light sources of both the natural sunlight and the fluorescent lights above (general office lighting).
Analysis	A verification method utilizing techniques and tools, such as math models, prior test data, simulations, analytical assessments, etc. Analysis may be used in lieu of, or in addition to, other methods to ensure compliance to specification requirements. The selected techniques may include, but not be limited to, task analysis, engineering analysis, statistics and qualitative analysis, computer and hardware simulations, and analog modeling. Analysis may be used when it can be determined that rigorous and accurate analysis is possible, test is not cost effective, and verification by inspection is not adequate.
Annunciate	To provide a visual, tactile, or audible indication.
Approach Ellipsoid	A 4 x 2 x 2 km ellipsoid, centered at the ISS center of mass, with the long axis aligned with the V-Bar.
Approach Initiation	The approach initiation is the first rendezvous maneuver during a nominal approach that is targeted to bring the vehicle inside the ISS approach ellipsoid (AE).
Ascent	The period of time from initial motion away from the launch pad until orbit insertion during a nominal flight or ascent abort initiation during an abort.
Ascent Abort	An abort performed during ascent, where the crewed spacecraft is separated from the launch vehicle without the capability to achieve the desired orbit. The crew is safely returned to a landing site in a portion of the spacecraft nominally used for entry and landing/touchdown.
Automated	Automatic (as opposed to human) control of a system or operation.
Autonomous	Ability of a space system to perform operations independent from any ground-based systems. This includes no communication with, or real-time support from, mission control or other ground systems.
Backout	During mission execution, the coordinated cessation of a current activity or procedure and careful return to a known, safe state.
Breakout	Any action that interrupts the nominally planned free flight operations that are intended to place the spacecraft outside of a threatening location to the cooperative vehicle. This may be an automated or manually executed action. For the ISS, the area within which a vehicle poses a threat to ISS is called the Approach Ellipse.

Cargo	An item (or items) required to maintain the operability of the ISS and/or the health of its crew, and that must be launched and/or returned.
Catastrophic Event	An event resulting in the death or permanent disability of a ground closeout or flight crewmember, or an event resulting in the unplanned loss/destruction of a major element of the CTS or ISS during the mission that could potentially result in the death or permanent disability of a flight crewmember.
Catastrophic Hazard	A condition that could result in the death or permanent disability of a ground closeout or flight crewmember, or in the unplanned loss/destruction of a major element of the CTS during the mission that could potentially result in the death or permanent disability of a flight crewmember.
Command	Directive to a processor or system to perform a particular action or function.
Communications Coverage	Communication coverage is defined as successful link availability for nominal ascent and entry trajectories.
Communications Link	A communication link is established, whereas the received commands and voice from the CVCC to the spacecraft and the transmitted health and status data, crew health and medical related data, voice, telemetry, and transmitted launch vehicle and spacecraft engineering data are received.
Consumable	Resource that is consumed in the course of conducting a given mission. Examples include propellant, power, habitability items (e.g., gaseous oxygen), and crew supplies.
Continental U.S. Airport	An airport within the continental United States capable of accommodating executive jet aircraft similar to the Gulfstream series aircraft.
Contingency	Provisioning for an event or circumstance that is possible but cannot be predicted with certainty.
Contingency Spacecraft Crew Support (CSCS)	CSCS is declared when the spacecraft crew takes shelter on the ISS because the spacecraft has been determined to be unsafe for reentry. In this case, a rescue mission is required to return the spacecraft crew safely.
Crew	Any human onboard the spacecraft after the hatch is closed for flight or onboard the spacecraft during flight.
Crew Transportation System (CTS)	The collection of all space-based and ground-based systems (encompassing hardware and software) used to conduct space missions or support activity in space, including, but not limited to, the integrated space vehicle, space-based communication and navigation systems, launch systems, and mission/launch control.
Critical Decision	Those technical decisions related to design, development, manufacturing, ground, or flight operations that may impact human safety or mission success, as measured by defined criteria.
Critical Fault	Any identified fault of software whose effect would result in a catastrophic event or abort.
Critical Function	Mission capabilities or system functions that, if lost, would result in a catastrophic event or an abort.
Critical Hazard	A condition that may cause a severe injury or occupational illness.
Critical Software	Any software component whose behavior or performance could lead to a catastrophic event or abort. This includes the flight software, as well as ground-control software.

Critical Software/Firmware	Software/Firmware that resides in a safety-critical system that is a potential hazard cause or contributor, supports a hazard control or mitigation, controls safety-critical functions, or detects and reports 1) fault trends that indicate a potential hazard and/or 2) failures which lead to a hazardous condition.
Critical (sub)System	A (sub)system is assessed as critical if loss of overall (sub)system function, or improper performance of a (sub)system function, could result in a catastrophic event or abort.
CTS Certification	CTS certification is the documented authorization granted by the NASA Associate Administrator that allows the use of the CTS within its prescribed parameters for its defined reference missions. CTS certification is obtained prior to the first crewed flight (for flight elements) or operational use (for other systems).
CTS Element	One component part of the overall Crew Transportation System. For example, the spacecraft is an element of the CTS.
Deconditioned	"Deconditioned" defines a space crewmember whose physiological capabilities, including musculoskeletal, cardiopulmonary, and neurovestibular, have deteriorated as a result of exposure to micro-gravity and the space environment. It results in degraded crewmember performance for nominal and off-nominal mission tasks.
Definitive Medical Care	An inpatient medical care facility capable of comprehensive diagnosis and treatment of a crewmember's injuries or illness without outside assistance—capable of care of Category I, II, and III trauma patients. Usually a Level I trauma center, as defined by the American College of Surgeons.
Demonstration	A method of verification that consists of a qualitative determination of the properties of a test article. This qualitative determination is made through observation, with or without special test equipment or instrumentation, which verifies characteristics, such as human engineering features, services, access features, and transportability. Human-in-the-loop demonstration is performed for complex interfaces or operations that are difficult to verify through modeling analysis, such as physical accommodation for crew ingress and egress. Demonstration requirements are normally implemented within a test plan, operations plan, or test procedure.
Docking	Mating of two independently operating spacecraft or other systems in space using independent control of the two vehicles' flight paths and attitudes during contact and capture. Docking begins at the time of initial contact of the vehicles' docking mechanisms and concludes when full rigidization of the interface is achieved.
Downrange Abort Exclusion Zone	A geographical region of the North Atlantic Ocean to be avoided for water landings during ascent aborts for ISS missions due to rough seas and cold water temperatures. The region is depicted in Figure B-1. The St. John's abort landing area includes the waters within 200 nmi range to St John's International Airport (47° 37' N, 52° 45' W). The Shannon abort landing area includes the waters within 200 nmi range to Shannon International Airport (52° 42' N, 8° 55' W). Note: The northern and southern bounds of the DAEZ in the ISS Mission DAEZ figure are notional, as these bounds are limited only by steering and cross-range performance along the ascent trajectory and are not formally constrained.

Downrange Abort Exclusion Zone Figure	 **Figure B-1 Ascent Downrange Abort Exclusion Zone**
Emergency	An unexpected event or events during a mission that requires immediate action to keep the crew alive or serious injury from occurring.
Emergency Egress	Capability for a crew to exit the vehicle and leave the hazardous situation or catastrophic event within the specified time. Flight crew emergency egress can be unassisted or assisted by ground personnel.
Emergency Equipment and Systems	Systems (ground or flight) that exist solely to prevent loss of life in the presence of imminent catastrophic conditions. Examples include fire suppression systems and extinguishers, emergency breathing devices, Personal Protective Equipment (PPE) and crew escape systems. Emergency systems are not considered a leg of failure tolerance for the nominal, operational equipment and systems, and do not serve as a design control to prevent the occurrence of a catastrophic condition.
Emergency Medical Services	Services required to provide the crewmembers with immediate medical care to prevent loss of life or aggravated physical or psychological conditions.
End of Mission	The planned landing time for the entire mission, including the nominal pre-flight agreed to docked mission duration.
Entry	The period of time that begins with the final commitment to enter the atmosphere from orbit or from an ascent abort, and ending when the velocity of the spacecraft is zero relative to the landing surface.
Entry Interface	The point in the entry phase where the spacecraft contacts the atmosphere (typically at a geodetic altitude of 400,000 feet), resulting in increased heating to the thermal protection system and remainder of the spacecraft exterior surfaces.
External Launch Constraint	Conditions outside the CTS provider's control, such as range weather constraints or faults with range or ISS assets, or weather constraints affecting abort rescue forces capabilities. Range weather examples include ability to visually monitor the initial phases of the launch for range safety, etc. Non-weather range constraints include range safety radar and telemetry systems availability, flight termination systems readiness, clearance of air, land, sea, etc.
Failure	Inability of a system, subsystem, component, or part to perform its required function within specified limits.

Failure Tolerance	The ability to sustain a certain number of failures and still retain capability. A component, subsystem, or system that cannot sustain at least one failure is not considered to be failure tolerant.
Fault	An undesired system state and/or the immediate cause of failure (e.g., maladjustment, misalignment, defect, or other). The definition of the term "fault" envelopes the word "failure," since faults include other undesired events, such as software anomalies and operational anomalies. Faults at a lower level could lead to failures at the higher subsystem or system level.
Flight Configuration	The arrangement, orientation and operational state of system elements and cargo, vehicle cabin layout, flight software mode, and crew complement, clothing and equipment in the applicable mission or ground phase necessary in verification to evaluate the attributes called out in the requirement.
Flight Hardware	All components and systems that comprise the internal and external portions of the spacecraft, launch vehicle, launch abort system, and crew worn equipment.
Flight Operations	All operations of the integrated space vehicle and the crew and ground teams supporting the integrated space vehicle from liftoff until landing.
Flight Phase	A particular phase or timeframe during a mission is referred to as a flight phase. The term "all flight phases" is defined as the following flight phases: pre-launch, ascent, onorbit free-flight, docked operations, deorbit/entry, landing, and post-landing.
Flight Representative	Description of a test-article used in verifications in which the attributes under evaluation are equivalent to the flight article. Example: Human-in-the-loop tests for spacecraft egress must use an equivalent cabin layout, seats and restraints, and hatch configuration and masses. However, the propulsion system does not need to be functional, as it is not under evaluation.
Flight Rules	Established redline limits for critical flight parameters. Each has pre-planned troubleshooting procedures with pre-approved decisions for expected troubleshooting results.
Flight Systems	Any equipment, system, subsystem or component that is part of the integrated space system.
Flight Termination	An emergency action taken by range safety when a vehicle violates established safety criteria for the protection of life and property. This action circumvents the vehicles' normal control modes and ends its powered and/or controlled flight.
Free Flight Operations	Onorbit operations that occur when the spacecraft is not in contact with any part of the ISS.
Ground Crew	Operations personnel that assist the flight crew in entering the spacecraft, closing the hatch, performing leak checks, and working on the integrated space vehicle at the pad during launch operations.
Ground Hardware	All components and systems that reside on the ground in support of the mission, including the Commercial Vehicle Control Center, launch pad, ground support equipment, recovery equipment, facilities, and communications, network, and tracking equipment.

Ground Processing	The work required to prepare the launch vehicle and spacecraft for mission from final assembly/integration/test through launch and resumes after landing for recovery of crew and cargo.
Ground Support Equipment	Any non-flight equipment, system(s), ground system(s), or devices specifically designed and developed for a direct physical or functional interface with flight hardware to support the execution of ground production or processing. The following are not considered to be GSE: • Tools designed for general use and not specifically for use on flight hardware. • Ground Support Systems that interface with GSE Facilities.
Habitable	The environment that is necessary to sustain the life of the crew and to allow the crew to perform their functions in an efficient manner.
Hazard	A state or a set of conditions, internal or external to a system, that has the potential to cause harm.
Hazard Analysis	The process of identifying hazards and their potential causal factors.
Health and Status Data	Data, including emergency, caution, and warning data, that can be analyzed or monitored describing the ability of the system or system components to meet their performance requirements.
Human Error	Either an action that is not intended or desired by the human or a failure on the part of the human to perform a prescribed action within specified limits of accuracy, sequence, or time that fails to produce the expected result and has led or has the potential to lead to an unwanted consequence.
Human Error Analysis (HEA)	A systematic approach used to evaluate human actions, identify potential human error, model human performance, and qualitatively characterize how human error affects a system. HEA provides an evaluation of human actions and error in an effort to generate system improvements that reduce the frequency of error and minimize the negative effects on the system. HEA is the first step in Human Risk Assessment and is often referred to as qualitative Human Risk Assessment.
Human-in-the-Loop Evaluation	Human-in-the-loop evaluations involve having human subjects, which include NASA crewmembers as a subset of the test subject population, perform identified tasks in a representative mockup, prototype, engineering, or flight unit. The fidelity of mockups used for human-in-the-loop evaluations may range from low-fidelity, minimal representation, to high-fidelity, complete physical and/or functional representation, relevant to the evaluation. Ideally, the fidelity of human-in-the-loop mockups and tests increases as designs mature for more comprehensive evaluations. Further information on human-in-the-loop evaluations throughout system design can be found in JSC 65995 CHSIP.
Human-System Integration	The process of integrating human operations into the system design through analysis, testing, and modeling of human performance, interface controls/displays, and human-automation interaction to improve safety, efficiency, and mission success.
Ill or Injured	Refers to a crewmember whose physiological and/or psychological well-being and health has deteriorated as a result of an illness (e.g., appendicitis) or injury (e.g., trauma, toxic exposure) and requires medical capabilities exceeding

	those available on the ISS and transportation to ground-based definitive medical care. Ill or injured crewmember performance for nominal and off-nominal mission tasks will be degraded.
Inspection	A method of verification that determines conformance to requirements by the use of standard quality control methods to ensure compliance by review of drawings and data. This method is used wherever documents or data can be visually used to verify the physical characteristics of the product instead of the performance of the product.
Integrated Operations	All operations starting at 90 minutes prior to the ISS Approach Initiation and lasting until the vehicle leaves the ISS Approach Ellipsoid on a non-return trajectory.
Integrated Space Vehicle	The integrated space vehicle consists of all the system elements that are occupied by the crew during the space mission and provide life support functions for the crew. The integrated space vehicle also includes all elements physically attached to the spacecraft during the mission. The integrated space vehicle is part of the larger space system used to conduct the mission.
Landing	The final phase or region of flight consisting of transition from descent to an approach, touchdown, and coming to rest.
Landing Site	**Supported Landing Sites:** A fully supported site on a Continental U.S. land mass or waters directly extending from the coast with CTS recovery forces on station at the time of landing. The landing site zone extends through nominally expected dispersions from the landing site point. Designated Primary Landing Site – A supported landing site-intended for landing at the time of spacecraft undock. Alternate Landing Site – A supported landing site to which the spacecraft landing can be diverted in the event the deorbit burn is delayed. **Unsupported Landing Sites:** Emergency Landing – Any unsupported site (land or water) arrived at due to critical failures that force immediate return and preclude landing at a designated primary or alternate landing sites.
Launch Commit Criteria	Established redline limits for critical launch parameters. Each has pre-planned troubleshooting procedures with pre-approved decisions for expected troubleshooting results.
Launch Opportunity	The period of time during which the relative position of the launch site, the ISS orbital plane, and ISS phase angle permit the launch vehicle to insert the spacecraft into a rendezvous trajectory with the ISS (northerly launches only due to range constraints). The ISS is in-plane with the Eastern Range approximately every 23 hours and 36 minutes.
Launch Probability	The probability that the system will successfully complete a scheduled launch event. The launch opportunity will be considered scheduled at 24 hours prior to the opening of the launch window.
Launch Vehicle	The vehicle that contains the propulsion system necessary to deliver the energy required to insert the spacecraft into orbit.
Life-Cycle	The totality of a program or project extending from formulation through implementation, encompassing the elements of design, development, verification, production, operation, maintenance, support, and disposal.

Loss of Crew	Death or permanently debilitating injury to one or more crewmembers.
Loss of Mission	Loss of, or the inability to complete enough of, the primary mission objectives, such that a repeat mission must be flown.
Maintenance	The function of keeping items or equipment in, or restoring them to, a specified operational condition. It includes servicing, test, inspection, adjustment/alignment, removal, replacement, access, assembly/disassembly, lubrication, operation, decontamination, installation, fault location, calibration, condition determination, repair, modification, overhaul, rebuilding, and reclamation.
Manual Control	The crew's ability to bypass automation in order to exert direct control over a space system or operation. For control of a spacecraft's flight path, manual control is the ability for the crew to affect any flight path within the capability of the flight control system. Similarly, for control of a spacecraft's attitude, manual control is the ability for the crew to affect any attitude within the capability of the flight/attitude control system.
MCC-H Mission Authority	• MCC-H has authority to make final decisions regarding spacecraft operations, including but not limited to Go/No-Go decisions and safety of flight and crew(s). • Beginning with either ISS integrated operations, or 30 minutes before the first required ISS configuration or crew activity in support of the spacecraft on rendezvous (e.g., ISS attitude maneuver, appendage configuration, USOS GPS configuration), whichever comes first. • Ending with either the end of ISS integrated operations, or when ISS is not required to maintain its configuration (e.g., ISS attitude, USOS GPS configuration, or appendages in a configuration) to support the spacecraft, whichever comes later. • Applies anytime the spacecraft free-drift trajectory, including dispersions, is predicted to enter the ISS AE within the next 24 hours.
Mission	The mission begins with entry of the crew into the spacecraft, includes delivery of the crew to/from ISS, and ends with successful delivery of the crew to NASA after landing.
Mission Critical	Item or function that must retain its operational capability to assure no mission failure (i.e., for mission success).
Operations Personnel	All persons supporting ground operations or flight operations functions of the CTS. Examples of these personnel are listed below: Persons responsible for the production, assembly/integration/test, validation, and maintenance of flight hardware, production facilities, launch site facilities, operations facilities, or ground support equipment (GSE). Persons involved with supporting or managing the launch countdown, crew training, or mission during flight. Persons involved in post-flight recovery.
Orbit	This flight phase starts just after final orbit insertion and ends at the completion of the first deorbit burn.
Override	To take precedence over system control functions.
Pad Abort	An abort performed where the crewed spacecraft is separated from the launch vehicle while the launch vehicle remains on the launch pad. As a result, the

	crewed spacecraft is safely transported to an area which is not susceptible to the dangers associated with the hazardous environment at the launch pad.
Permanent Disability	A non-fatal occupational injury or illness resulting in permanent impairment through loss of, or compromised use of, a critical part of the body, to include major limbs (e.g., arm, leg), critical sensory organs (e.g., eye), critical life-supporting organs (e.g., heart, lungs, brain), and/or body parts controlling major motor functions (e.g., spine, neck). Therefore, permanent disability includes a non-fatal injury or occupational illness that permanently incapacitates a person to the extent that he or she cannot be rehabilitated to achieve gainful employment in their trained occupation and results in a medical discharge from duties or civilian equivalent.
Portable Fire Suppression System	A system comprised of one or more portable handheld fire extinguishers and access ports. These access ports allow the user to discharge fire suppressant into enclosed areas with potential ignition sources. See also 3.10.12.2 Use of Hazardous Chemicals.
Post-Landing	The mission phase beginning with the actual landing event when the vehicle has no horizontal or vertical motion relative to the surface and ending when the last crewmember is loaded on the aircraft for return to JSC.
Proximity Operations	The flight phase including all times during which the vehicle is in free flight beginning just prior to Approach Initiation (AI) execution and ending when the vehicle leaves the Approach Ellipsoid (AE).
Quiescent Docked Operations	The state of the CTS spacecraft while it is docked to the ISS with hatches open and ISS services, as called out in SSP 50808, connected and operational. From this state, the vehicle can support immediate ingress and transition into safe haven in the case of an emergency.
Recovery	The process of proceeding to a designated nominal landing site, and retrieving crew, flight crew equipment, cargo, and payloads after a planned nominal landing.
Reliability	The probability that a system of hardware, software, and human elements will function as intended over a specified period of time under specified environmental conditions.
Rendezvous	The flight phase of executing a series of onorbit maneuvers to move the spacecraft into the proximity of its target. This phase starts with orbit insertion and ends just prior to the approach initiation.
Safe Haven	A functional association of capabilities and environments that is initiated and activated in the event of a potentially life-threatening anomaly and allows human survival until rescue, the event ends, or repair can be affected. It is a location at a safe distance from or closed off from the life-threatening anomaly.
Safety	The absence from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment.
Safety Critical	A condition, event, operation, process, function, equipment or system (including software and firmware) with potential for personnel injury or loss, or with potential for loss or damage to vehicles, equipment or facilities, loss or

	excessive degradation of the function of critical equipment, or which is necessary to control a hazard.
Search and Rescue	The process of locating the crew, proceeding to their position, and providing assistance.
Software	Computer instructions or data stored electronically. Systems software includes the operating system and all the utilities that enable the computer to function. Applications software includes programs that do real work for users, such as word processors, spreadsheets, data management systems, and analysis tools. Software can be Commercial Off-The-Shelf (COTS), contractor developed, Government furnished, or combinations thereof.
Spacecraft	All system elements that are occupied by the crew during the space mission and provide life support functions for the crew. The crewed element includes all the subsystems that provide life support functions for the crew.
Space System	The collection of all space-based and ground-based systems (encompassing hardware and software) used to conduct space missions or support activity in space, including, but not limited to, the integrated space vehicle, space-based communication and navigation systems, launch systems, and mission/launch control.
Stowage	The accommodation of physical items in a safe and secure manner in the spacecraft. This does not imply that resources other than physical accommodations (e.g., power, thermal, etc.) are supplied.
Subsystem	A secondary or subordinate system within a system (such as the spacecraft) that performs a specific function or functions. Examples include electrical power, guidance and navigation, attitude control, telemetry, thermal control, propulsion, structures subsystems. A subsystem may consist of several components (hardware and software) and may include interconnection items such as cables or tubing and the support structure to which they are mounted.
System	The aggregate of the ground segment, flight segment, and workforce required for crew rescue and crew transport.
Task Analysis	Task analysis is an iterative human-centered design process through which user tasks are identified and analyzed. It involves 1) the identification of the tasks and subtasks involved in a process or system, and 2) analysis of those tasks (e.g., who performs them, what equipment is used, under what conditions, the priority of the task, dependence on other tasks). The focus is on the human and how they perform the task, rather than the system. Results can help determine the hardware or software that should be developed/used for a particular task, the ideal allocation of tasks to humans vs. automation, and the criticality of tasks, which drive design decisions. Further information on task analysis can be found in JSC 65995 CHSIP, Section 4.1.
Test	A method of verification in which technical means, such as the use of special equipment, instrumentation, simulation techniques, and the application of established principles and procedures, are used for the evaluation of components, subsystems, and systems to determine compliance with requirements. Test will be selected as the primary method when analytical techniques do not produce adequate results; failure modes exist, which could compromise personnel safety, adversely affect flight systems or payload operation, or result in a loss of mission objectives. The analysis of data

	derived from tests is an integral part of the test program and should not be confused with analysis as defined above. Tests will be used to determine quantitative compliance to requirements and produce quantitative results.
Validation	Proof that the product accomplishes the intended purpose. May be determined by a combination of test, analysis, and demonstration.
Verification	Proof of compliance with a requirement or specifications based on a combination of test, analysis, demonstration, and inspection.

Appendix C: Insight Areas

Areas open to Government insight include, but are not limited to:

1. Approved plans and changes to plans, approaches, and activities for Commercial Provider's Configuration Management, Risk Management, Safety and Mission Assurance, Quality Management, and Systems Effectiveness.
    a. Commercial Provider quality system audits
2. Commercial Provider-chaired boards and reviews.
    a. Design, technical, and safety review boards
    b. Systems test and production reviews
    c. Critical flight hardware pedigree and hardware acceptance reviews
    d. Pre-ship readiness reviews
    e. Post-test, post-launch, and flight data review
    f. Material review boards
    g. Certification and FRRs
3. Design, test, production, and operations schedules, work practices, documentation, and procedures.
4. Design, production, and operations requirements.
5. CTS drawings, analyses, models.
    a. Hardware design, analysis, manufacture, and test data
    b. Software design, analysis, and test data
    c. Human-system integration evaluations
    d. Interface control documents/drawings (ground/launch vehicle/spacecraft, and spacecraft/ISS)
    e. CTS system-handling procedures and deviations
    f. Safety and reliability and hazard analyses
    g. Failure analysis
6. Design, production, and operations certification and qualification plans, tests, test reports, and supporting data.
    a. Major system and integrated systems tests
    b. CTS production, launch site integration, and testing
    c. Launch countdown procedures for the CTS
    d. Mission planning and coordination
7. Design, test, production, and operations data.
    a. Operations Plans
    b. Mission/crew timelines, flight rules, Launch Commit Criteria
    c. Trajectory design and planning, including rendezvous and proximity operations
    d. Launch site preparations and closeout data
    e. Post-flight, tracking, and range data
    f. Post-flight anomaly investigations/closeouts including flight data
    g. Walk downs and inspections
8. Flight simulations, dress rehearsals, crew training, simulation and training for all mission phases (docking and undocking).
9. Major/critical problems and anomaly resolutions including aborts.
10. Agreements and procedures applicable to range operations.
11. Agreement and procedures for coordination with STRATCOM (MMOD impact).
12. Training and certification plan for crew and ground operators.